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GB 2139047 A   US 5131020 A

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(54) Abstract Title
Automatically downloading data according to predicted data requirements

(57) In a cellular network, a base station analyses data associated with the calls made by users of that station in order to form usage profiles of users. The profiles are stored in a database, which is then used to calculate future usage. On the basis of those calculations, speculative connections are made available to specific users at times that are optimum from the station's perspective (eg during periods of low network activity), in anticipation of demand. The invention is particularly applicable to data networks wherein users typically access data services (such as Internet pages) at the same time each day. A change analyser may be included in order to determine the degree of change occurring in data pages and decide whether a whole page or just the modifications to the page should be sent to the subscriber. Call related data may include dialled call destination, time of call, location from which call is dialled out/received, access to Internet, access to information services etc.
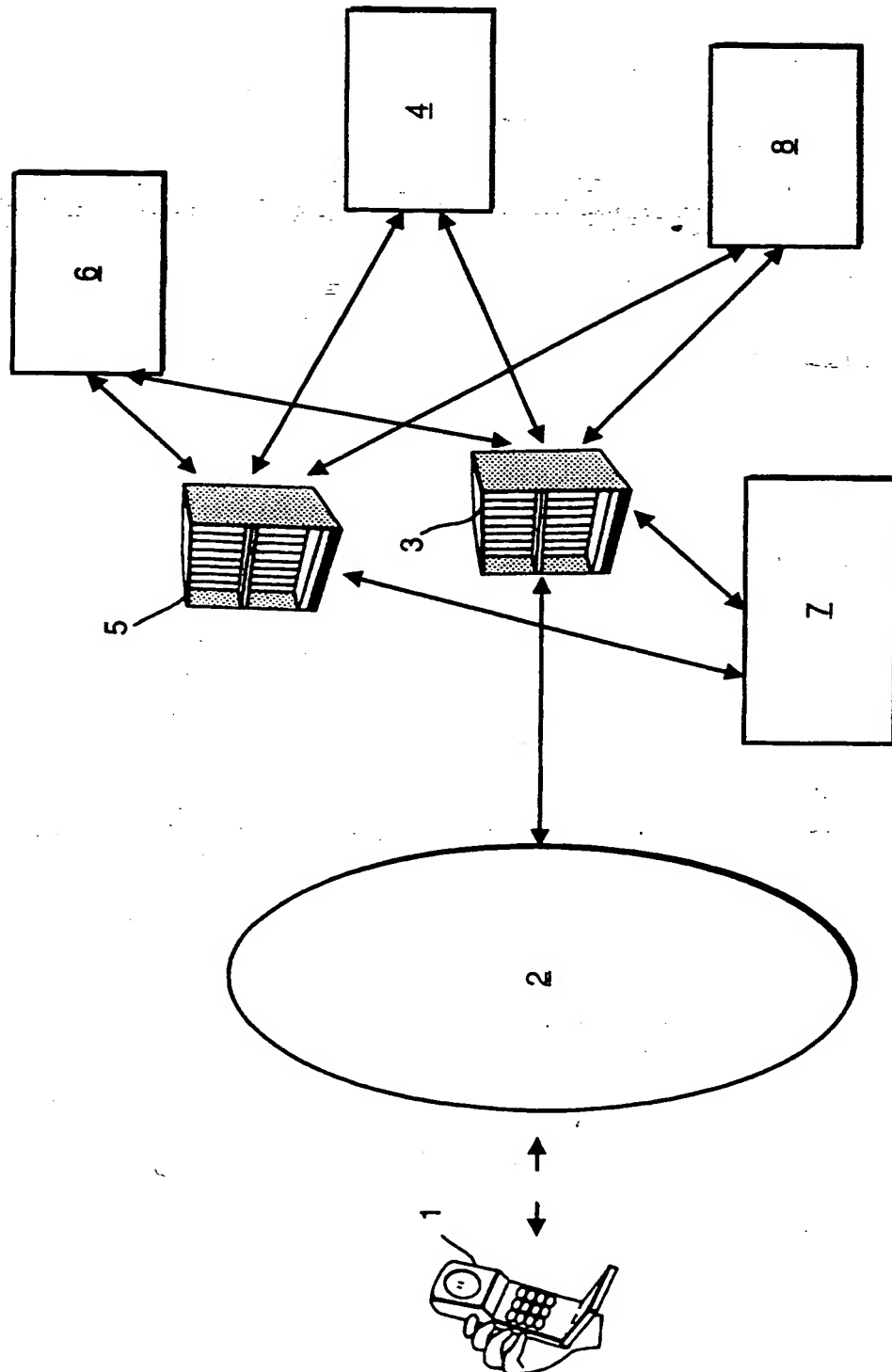
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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1995

FIG.1

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METHOD OF OPERATING A CELLULAR NETWORK

This invention relates to a method of operating a cellular radio communication network in a manner that can increase its efficiency.

In cellular radio communication networks the final link between the network and the user is by radio. The mobile units carried by users are assigned a duplex radio channel and communicate with an assigned base station. The particular base station assigned will depend upon the location of the user, i.e. in which cell the user is located. Each base station has an assigned carrier frequency with a limited bandwidth, the carrier frequency differing from those of adjacent cells to avoid co-channel interference. The bandwidth assigned to each base station limits the number of mobiles that can be serviced and at times of peak usage this capacity may be exceeded preventing some users from communicating.

Cellular radio networks may be used to carry speech or data in analogue or digital form. The present invention enables improved channel usage when supplying digitally encoded data.

According to the present invention there is provided a method of increasing the utilisation factor of a cellular network providing digitally encoded information character-ised in that the calls of each user are monitored and data relevant to the times, destination and location of each user is used to form a user profile which is stored on a user database, future call usage is calculated and thereafter speculative connections to the user are made at times that are optimum from an operator's perspective in anticipation of demand.

In general the calls of each user are monitored and the specific elements of the users behaviour are measured to obtain a profile of the user's behaviour. In particular the location and regular movements over time for a mobile

5 user are catalogued. Also the user's information service requirements are catalogued so that any patterns of regular behaviour, e.g. weather check at a fixed time each day within a particular are detected. Such patterns of behaviour are not unusual. A user travelling to the same

10 workplace daily may make a traffic status check when reaching a point on the journey at which a travel route decision must be made; on the basis of the information received through the check the user will chose the onward route. Such behaviour will enable the network to cache the

15 required information either locally within its own databases allowing rapid access upon user request, or to download the data to the user's terminal in advance of the users request, allowing it to be immediately available.

20 Another pattern type involves regular access of certain pages on an Internet web site. These pages can be accessed in advance of the user's call and downloaded into a local terminal memory. This terminal can be used to supply the changes to the site since it was last accessed

25 reducing the amount of data that has to be transmitted to the user. Such an arrangement reduces the bandwidth needed to transmit the information and increases the speed at which the information can be updated in the user's system.

30 A copy of regularly accessed web site pages may be stored in a terminal for rapid downloading to any user requiring the information. The page can be maintained using very little communication bandwidth by receiving only changes to the pages while the whole page is stored by the

35 the terminal memory. Changes that occur are used to

maintain an up-to-date record of the site page or pages in the terminal which can be sent to a user when requested without the delay and usage of communication links to the Internet that would be involved if the request had not been

5   anticipated. In the situation where the user holds the relevant page or pages in memory only the update information need be transmitted providing further economies in usage time.

10   An illustration of an equipment combination for implementing the method of increasing the utilisation factor of a cellular network according to the invention will now be described with reference to Figure 1 of the accompanying drawing.

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A mobile user 1 having a terminal communicates with a cellular network 2 through a radio link indicated by the double headed arrow. The cellular network may be a GSM, PCN or other network using cellular techniques for the

20 purpose of managing calls to and from mobile users. The network 2 must possess the facility for obtaining and feeding data relating to the locations and call destinations of the user 1 to a customer activity database 3 where the information is stored. The information in the

25 database 3 is supplied to an inference engine 4 where future service requests of the user 1 are predicted. The information accessed from the database 3 will comprise a number of items such as dialled call destination, occurrence time of calls, location of user terminal when

30 each call is dialled out or when a call is received, location of the user terminal when registered on the network over each 24 hour period, any access requests to Internet or equivalent network, any access requests to information services. Accountancy details may also be

35 stored such as suspension of service due to insufficient

funds and/or proximity by the user to any credit limit on the account. The usage predictions evolved by the inference engine 4 are interchanged with the database 3 and also with an expected user activity database 5 where this information is stored and accessed by other units comprising the system.

The database 3 is also linked to a conventional Internet proxy server 6, a transmission co-ordinator 7 and a change analyser 8. The data provided to the transmission co-ordinator 7 includes the likely information requirement of a user terminal 1 calculated by the inference engine and also the amount of change that has occurred to the information services and/or websites regularly accessed by the user terminal 1. On the basis of the data supplied to it and its network knowledge, such as the available bandwidth on the network 2, the co-ordinator 7 decides if and when the user terminal should be updated with changes that have occurred on the user's regularly used pages. This information is interchanged with that stored on the database 3.

The change analyser 8 reviews pages downloaded from the various services regularly accessed by the user as predicted by the inference engine 4. The analyser 8 analyses the level of change to the pages and makes a decision as to whether the changes alone should be transmitted or whether the complete page should be replaced.

The activity of each mobile terminal user 1 is fed to the customer activity database 3 enabling, through predictions by the inference engine 4, a set of data to be transferred and stored in the expected customer activity database 6. The stored information can be used for

anticipating user requests for a period of a day, week or more before being revised and updated in respect of any changes in the user pattern of behaviour.

5   Examples of user behaviour that allows predictions to be made include (1) daily travel patterns based on locations stored when the cellular network is accessed, (2) requests for interactions with specific network based applications, (3) requests for updates from the proxy

10   server of specific information items accessed through the Internet, and (4) requests for specific information services.

The change analyser monitors the level of change that

15   is occurring on the information sources regularly accessed by the user as available from the expected customer activity database. The frequency of such changes is used to make the update or refresh decision with regard to information stored in expectance of user access. The

20   stored information can be downloaded in anticipation of a user request to the relevant terminal for customer access through the operation of the transmission co-ordinator. If the user is able to accommodate changes in information only this can be implemented by the transmission co-ordinator.

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In operating the method according to the invention on the basis of the operations of transmission co-ordinator and the knowledge of traffic loads on the cellular network on a time basis data can be transmitted using parts of the

30   cellular network that are lightly loaded at the the time in anticipation of a user request. Such an arrangement reduces the load on the cellular network at peak periods avoiding the need to extend facilities to accommodate the full peak load.

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Claims ‹

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1   A method of operating a cellular radio communication network able to provide digitally-encoded information to its users, including the steps of:

monitoring the calls of each user to build up a database;

feeding into the database data relating to the time and destination of each call placed, and the location of the respective user at the time of placing each call;

building up from the stored data a profile of each user being monitored;

storing each profile in the database;

using each profile to estimate the future use by the user, and

making speculative connections to the user at times chosen in accordance with the estimate and which are optimum from the operator's perspective, in anticipation of demand.

2   A method as claimed in claim 1, in which the database has fed into it data relating to each user's information requirements, and in which those data are analysed to detect any patterns of usage.

3   A method as claimed in claim 2, in which the network is operated to cache the information, which it calculates from a stored pattern is likely to be required by each user, before the respective request for that information has been made, either locally within its own databases or into the user's terminal.

4   A method as claimed in claim 3, in which the cached data include one or more pages of an Internet web site.

5   A method as claimed in claim 3 or claims 3 and 4, in which the cached data are updated with changes in the information at a previously-interrogated site since it was last accessed, and in which only the changes are supplied to the user, to update the user's database, when the user next tries to access the site.

6   A method as claimed in claim 5, in which a copy of regularly-accessed Web site pages is stored in a network database for rapid downloading to any user requiring the information.

7   A method as claimed in claim 6, in which the stored pages are updated periodically at times convenient to the network.

The Patent Office

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Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
UK Cl (Ed.P): H4L (LFM, LDGX)
Int Cl (Ed.6): H04Q (7/22, 7/32, 7/34, 7/38)
Other: On-Line - WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2 139 047 A (GEC) See abstract	-
A	US 5 131 020 (SmartRoutes) See abstract	-